CLAIMS

1. Device for analyzing qualities of a tissue, such as tissue thickness, tissue surface roughness and/or degree of tissue fiber linearization, comprising at least one light generating means (8, 14, 15), a probe (1) with an extension (3), at least one fiber bundle (7, 17) arranged in said extension (3), for conveying light from said light generating means (8, 14, 15) to illuminate the surface of said tissue, and at least one light detecting means (5, 20) c h a r a c t e r i z e d in

that said light generating means (8, 14, 15) generates light of known intensity, of at least one wavelength and including at least one polarization vector;

that said extension (3) is designed for conveying light back-scattered from said tissue to said light detecting means (5, 20), possibly including at least one fiber bundle (19);

that said light detecting means (5, 20) is designed for measuring the intensity and/or spatial distribution of light back-scattered from said tissue for at least one wavelength;

that said intensity and/or spatial distribution detected by said light detecting means (5, 20) is analyzed to derive qualities of said tissue, such as tissue thickness, tissue surface roughness and/or degree of tissue fiber linearization.

2. Device according to claim 1, further comprising a control apparatus (6).

3. Device according to claim 2 wherein said control apparatus (6) comprises means for controlling said light generating means (8, 14, 15) and/or a signal processor (13) configured to apply a tissue thickness and/or tissue fiber linearization algorithm on data acquired by said light detecting means (5, 20).

4. Device according to claim 3 wherein said light generating means (8, 14) includes means for generating light of at least two wavelengths including reference light and measurement light, where said reference light and measurement light are conveyed through said fiber bundle (7) in said extension (3) for illumination of said tissue surface, where said light detecting means (5, 20) is designed to measure intensities of back-scattered parts of said reference light and measurement light, and where said signal processor (13) in said control apparatus (6) includes means for comparing said measured intensities of back-scattered reference light and measurement light in order to determine the thickness of said tissue.

5. Device according to claim 4 wherein said light detecting means (5) is a two-dimensional intensity detector.

6. Device in accordance with any of claims 4 – 5 where said light generating means (8, 14) is a white light source for visualization of said tissue, and said reference light and measurement light are extracted from said white light source by a material selected to pass said reference light and measurement light.

7. Device in accordance with any of claims 4 – 6 comprising means for multiplexing said reference light and measurement light emitted from said light generating means (8, 14).

8. Device according to claim 3 where said light generating means (8, 14) is a light source generating white light, where said white light is conveyed through said fiber bundle (7) in said extension (3) for illumination of said tissue, where said light detecting means (5, 20) is designed to measure intensities of back-scattered parts of said white light for at least two wavelengths, and where said signal processor (13) in said control apparatus (6) includes means for comparing said measured intensities at the wavelengths of said reference light and measurement light in order to determine the thickness of said tissue.

9. Device according to claim 8 wherein said light detecting means (5) is a two-dimensional intensity detector.

10. Device in accordance with any of claims 1 – 3 wherein said light generating means (8, 14) includes means for generating light of at least two wavelengths including reference light and measurement light, where said reference light and measurement light are conveyed through said fiber bundle (7) in said extension (3) for illumination of said tissue, and where said extension (3) is designed for conveying light back-scattered from said tissue to an eye-piece (18) for visual inspection.

11. Device according to claim 10 where said light generating means (8, 14) is a white light source for visualization of said tissue, and said reference light and measurement light are extracted from said white light source by a material selected to pass said reference light and measurement light.

12. Device in accordance with any of claims 10 – 11 comprising means for multiplexing said reference light and measurement light emitted from said light generating means (8, 14).

13. Device in accordance with any of claims 4 – 12 where the wavelength of said reference light is within a wavelength region where similar absorption between the components of said tissue is seen.

14. Device according to claim 13 where said tissue components are cartilage and bone and the wavelength of said reference light is within the 600 – 800 nm wavelength range.

15. Device in accordance with any of claims 4 – 12 where the wavelength of said measurement light is within a wavelength region where differences in absorption between the components of said tissue are seen.

16. Device according to claim 15 where the wavelength of said measurement light is within a wavelength region corresponding to a hemoglobin absorption peak, preferably in the vicinity of 425, 542 or 576 nm, or within a wavelength region with high water absorption, preferably the near-infrared region.

17. Device according to claim 3 wherein said light generating means (15) includes means for generating polarized and non-polarized light, where said polarized and non-polarized light are conveyed through said fiber bundle (17) in said extension (3) for illumination of said tissue, where said light detecting means (5, 20) is designed to measure intensities of back-scattered parts of said polarized and non-polarized light, and where said signal processor (13) in said control apparatus (6) includes means for comparing said measured intensities of back-scattered polarized and non-polarized light in order to determine the fiber linearization of said tissue.

18. Device according to claim 17 wherein said light detecting means (5) is a two-dimensional intensity detector.

19. Device in accordance with any of claims 17 – 18 where said light generating means (15) is a light source generating white light for visualization of said tissue, and said polarized and non-polarized light are extracted from said white light by a material (16) selected to pass certain polarization states.

20. Device according to claim 19 where the direction of the polarization vector of said polarized light is determined by said material (16), as controlled by said control apparatus (6).

21. Device in accordance with any of claims 17 – 20 where said fiber bundle (17) conveying light from said light generating means (15) to said tissue is designed to maintain polarization state of said polarized light.

22. Device in accordance with any of claims 17 – 21 comprising means for multiplexing said polarized and non-polarized light emitted from said light generating means (15).

23. Device according to claim 19 where said material (16) is positioned at the distal end of said extension (3) of said probe (1).

24. Device in accordance with any of claims 1 – 3 wherein said light generating means (15) includes means for generating polarized and non-polarized light, where said polarized and non-polarized light are conveyed through said fiber bundle (17) in said extension (3) for illumination of said tissue, and where said extension (3) is designed for conveying light back-scattered from said tissue to an eye-piece (18) for visual inspection.

25. Device according to claim 24 where said light generating means (15) is a light source generating white light for visualization of said tissue, and said polarized and non-polarized light are extracted from said white light by a material (16) selected to pass certain polarization states.

26. Device according to claim 25 where the direction of the polarization vector of said polarized light is determined by said material (16), as controlled by said control apparatus (6).

27. Device in accordance with any of claims 24 – 26 where said fiber bundle (17) conveying light from said light generating means (15) to said tissue is designed to maintain polarization state of said polarized light.

28. Device in accordance with any of claims 24 – 27 comprising means for multiplexing said polarized and non-polarized light emitted from said light generating means (15).

29. Device according to claim 25 where said material (16) is positioned at the distal end of said extension (3) of said probe (1).

30. Method for measuring tissue qualities, such as tissue thickness, tissue surface roughness and degree of tissue fiber linearization, wherein a device according to any of claims 1–29 is used.